First Great Western

READING TURBO MAINTENANCE DEPOT

CLASS 165/166 TURBO

AIR SUPPLY & DISTRIBUTION SYSTEM

First
165 103

CLASS 165
AIR SUPPLY AND DISTRIBUTION SYSTEM

CLASS 165 AIR SUPPLY & DISTRIBUTION SYSTEM

1. Introduction

Each Class 165 vehicle has an engine driven compressor which provides the air supply for the main reservoir system and the engine control system. It is the reservoir system that supplies the brake air supply, the door gear air supply, the air suspension system and the other air systems on the vehicle.

A system of coolers, condensers and dryers is used to ensure the air from the compressor is both cool and clean before it is supplied to the main reservoir system.

2. Air Supply System

Air for the compressor is drawn through an Air Intake Filter compressed, and passed to the air system via a high pressure PTFE hose. A Safety Valve protects the air systems.

2.1 Engine Air System

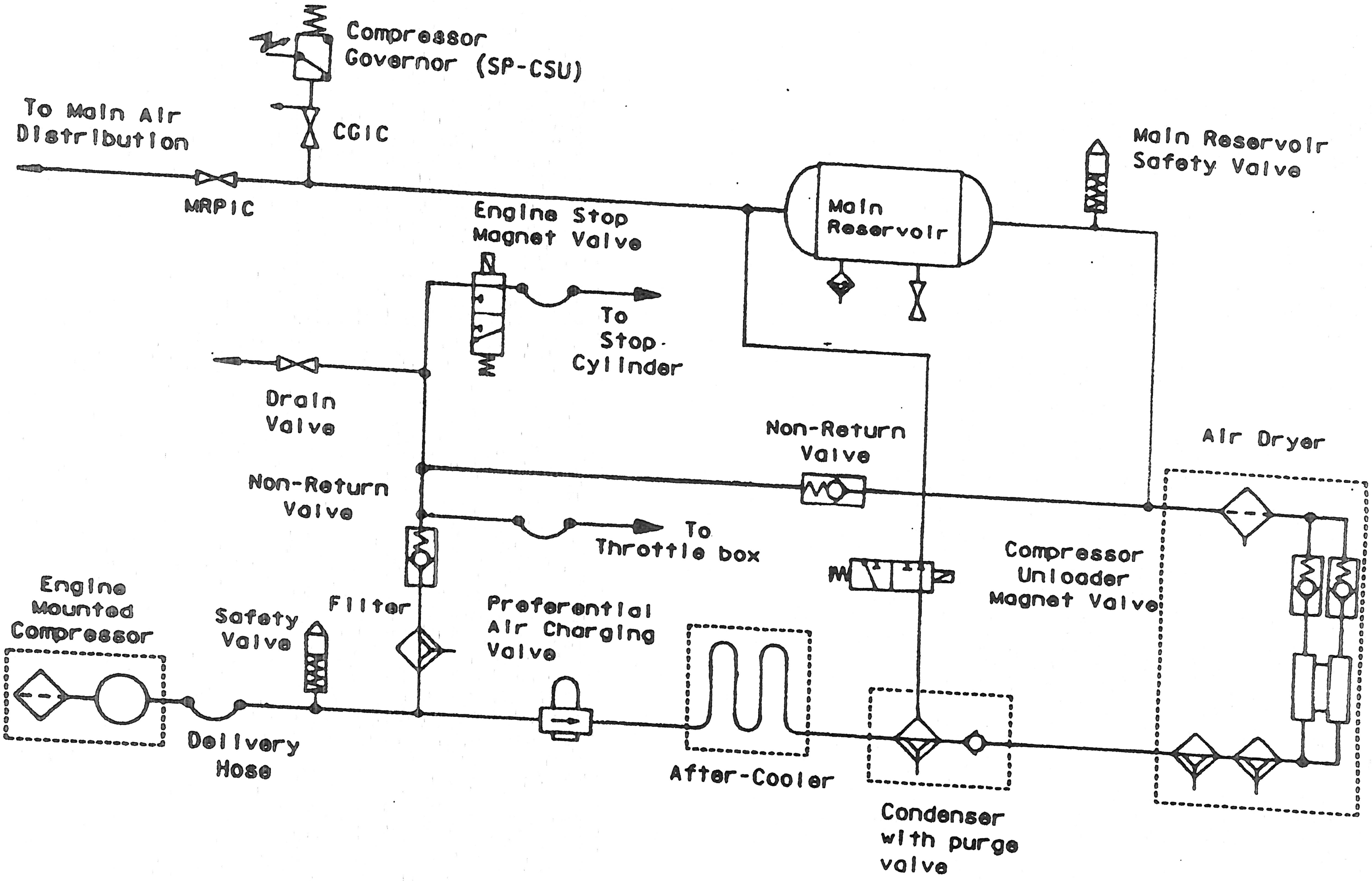
After the safety valve the air passes through a "Filter" and Non-Return valve to the Throttle Box and Engine Stop Magnet Valve. There is a manual drain cock to allow water etc. to be removed from the pipework in the area. Operation of the Engine Stop e.p. valve supplies air to the Engine Stop Cylinder to allow the engine to be started.

If say the Delivery Hose breaks, the loss of air pressure could cause the Engine Stop Cylinder to stop the engine. This is avoided if the main reservoir pipe pressure on the vehicle is still charged (from another vehicle) when air is supplied to the engine systems by a second non-return valve. This facility can also be of assistance when starting the engine.

2.2 Main Reservoir Air Supply System

This system is supplied via a "Preferential Air Charging Valve". This valve ensures that priority is given to the Engine Air Systems when the air pressure is low i.e. usually during the engine start sequence after a long shut-down period - the battery turns over the engine, driving the compressor and producing the air to operate the engine stop cylinder.
If the air pressure is high enough the preferential air charging valve will pass air through the sir supply system.

There is an "After Cooler" and then a "Condenser" with purge valve to extract water from the compressed air.
Any moisture remaining in the air is extracted by a two tower "Air Dryer" before the air passes to the main reservoir via the Main Reservoir Safety Valve.
The main reservoir tank is fitted with both automatic and manual drain valves and feeds the main reservoir distribution system system via a Main Reservoir Pipe Isolating Cock MRPIC.
The air pressure in the Main Reservoir is regulated by a Compressor Governor (SP-CSU) which controls the pressure by unloading (venting air) at the condenser using a Compressor Unloader Magnet Valve. The compressor governor can be isolated using the compressor governor manual isolating/drain cock CGIC.


Compressor Governor (SP-CSU)
CGIC
To Main Air Distribution
MRPIC
Engine Stop Magnet Valve
Main Reservoir
Main Reservoir Safety Valve
To Stop Cylinder
Drain Valve
Non-Return Valve
Non-Return Valve
Air Dryer
To Throttle box
Compressor Unloader Magnet Valve
Engine Mounted Compressor
Safety Valve
Filter
Preferential Air Charging Valve
Delivery Hose
After-Cooler
Condenser with purge valve

MAIN AIR PRODUCTION AND PREPARATION

2.3 MAIN AIR DISTRIBUTION

The air produced by the compressor on each vehicle feeds the Local Main Reservoir Pipe (LMRP) which feeds the vehicle Brakes Air System, Air Suspension System, Cab Air Distribution System and Auxiliary Air System.

The Local Main Reservoir Pipe also supplies the Main Reservoir Pipe MRP via a Non-Return Valve. The main reservoir pipes on each vehicle are automatically connected to one another as vehicles/units are coupled via the BS1 couplings.

Isolating cocks allow the main reservoir pipe on each vehicle to be isolated from other vehicles as required. Usually this will only be necessary if a main reservoir pipe has burst. This would be detected by the low main reservoir governor which applies the brake if the main reservoir pressure falls below   bar. The operation of this governor can be checked using the test point on the main reservoir.

If the pressure in the Local main Reservoir Pipe falls below the Main Reservoir Pipe pressure (usually if the compressor fails) then it is possible to maintain the Local Main Reservoir Pipe pressure from the Main Reservoir Pipe, via the Main Reservoir Pipe Filter Isolating Cock (MRPFIC), a combined water separator and coalescing oil filter and a Non-Return Valve.

The Coalescing Filters are to ensure the air is both clean and has the moisture removed if the main reservoir pipe is fed from a vehicle with an unfiltered and undried air supply.

Facilities are available to allow the main reservoir pipe to be supplied from an external source during assistance moves or during maintenance.

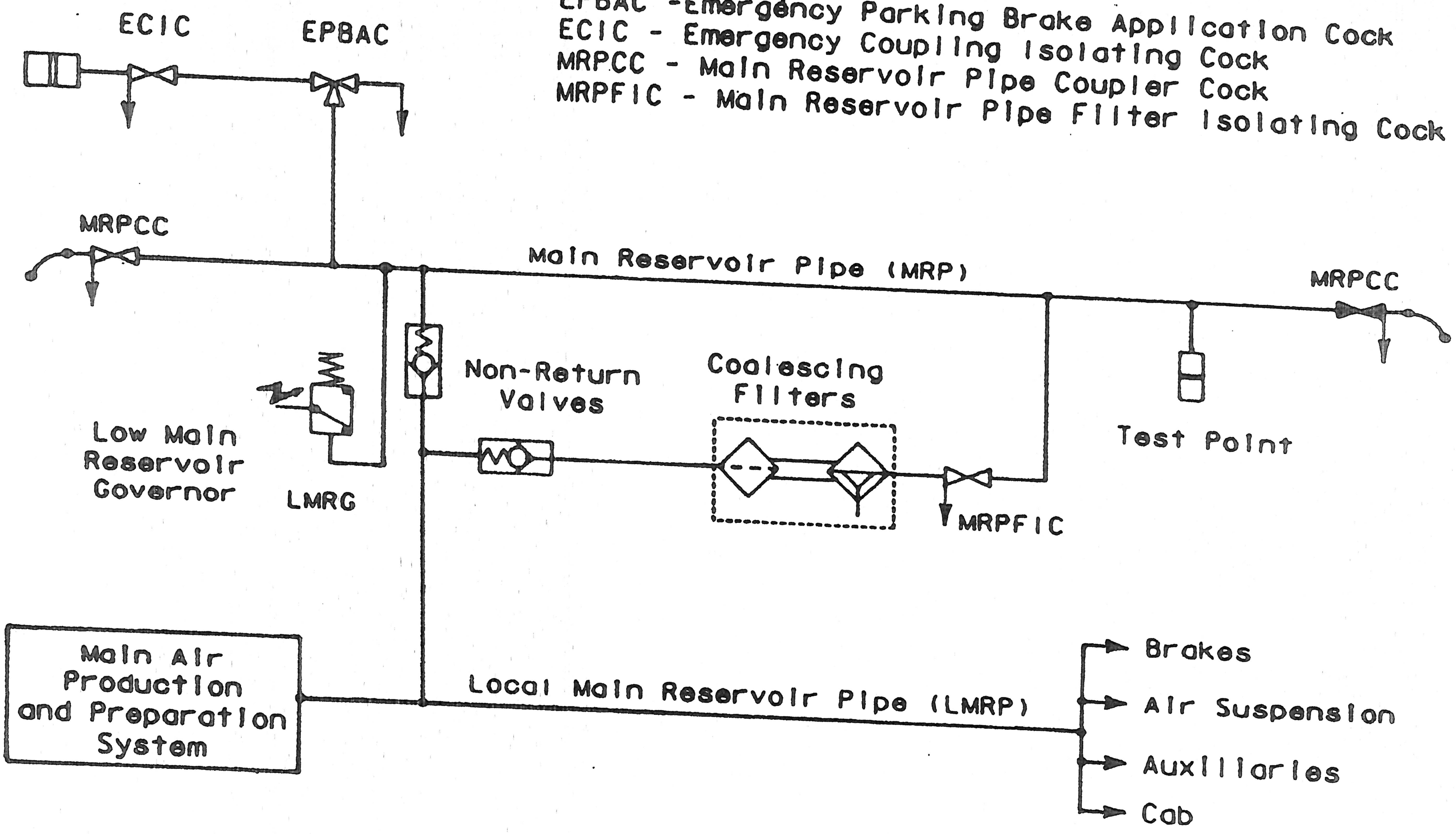
A schraedar coupling is located at the driving end of each vehicle for this purpose.

An air supply connected to this coupling is fed to the main reservoir pipe via the normally closed (isolate) Emergency Coupling Isolating Cock ECIC (which is also a drain cock) and the Emergency Parking Brake Application Cock EPBAC.

The ECIC is found under the cab and the EPBAC on the non-driving side of the cab in a locked cupboard.

The purpose of the EPBAC is to allow a brake application in a Class 165 during certain assistance moves when the brake cannot be controlled electrically. Operation of the EPBAC will shut off the air supply from the schraedar coupling to the main reservoir pipe and then vent the main reservoir pipe. This also vents the local main reservoir pipe and causes the parking brakes to apply.

EPBAC -Emergency Parking Brake Application Cock
ECIC - Emergency Coupling Isolating Cock
MRPCC - Main Reservoir Pipe Coupler Cock
MRPFIC - Main Reservoir Pipe Filter Isolating Cock


ECIC
EPBAC
MRPCC
Main Reservoir Pipe (MRP)
MRPCC
Non-Return Valves
Coalescing Filters
Test Point
Low Main Reservoir Governor
LMRG
MRPFIC
Main Air Production and Preparation System
Local Main Reservoir Pipe (LMRP)
Brakes
Air Suspension
Auxiliaries
Cab

MAIN AIR DISTRIBUTION

2.4 Local Air Distribution System

There are three main distribution points for the Local Main Reservoir Pipe; in the cab, at the brake control unit and an underframe distribution point.
Under a cover in the drivers desk there are 5 isolating cocks which control the air supply to :-

a) Cab Doors
b) Autocoupler
c) Parking Brake
d) Windscreen Wash/Wipe System
e) Warning Horns

At the brake control unit there are:-

a) Brake Supply Reservoir Isolating Cock controlling the brake air supply.

b) Air Suspension System Isolating Cocks.

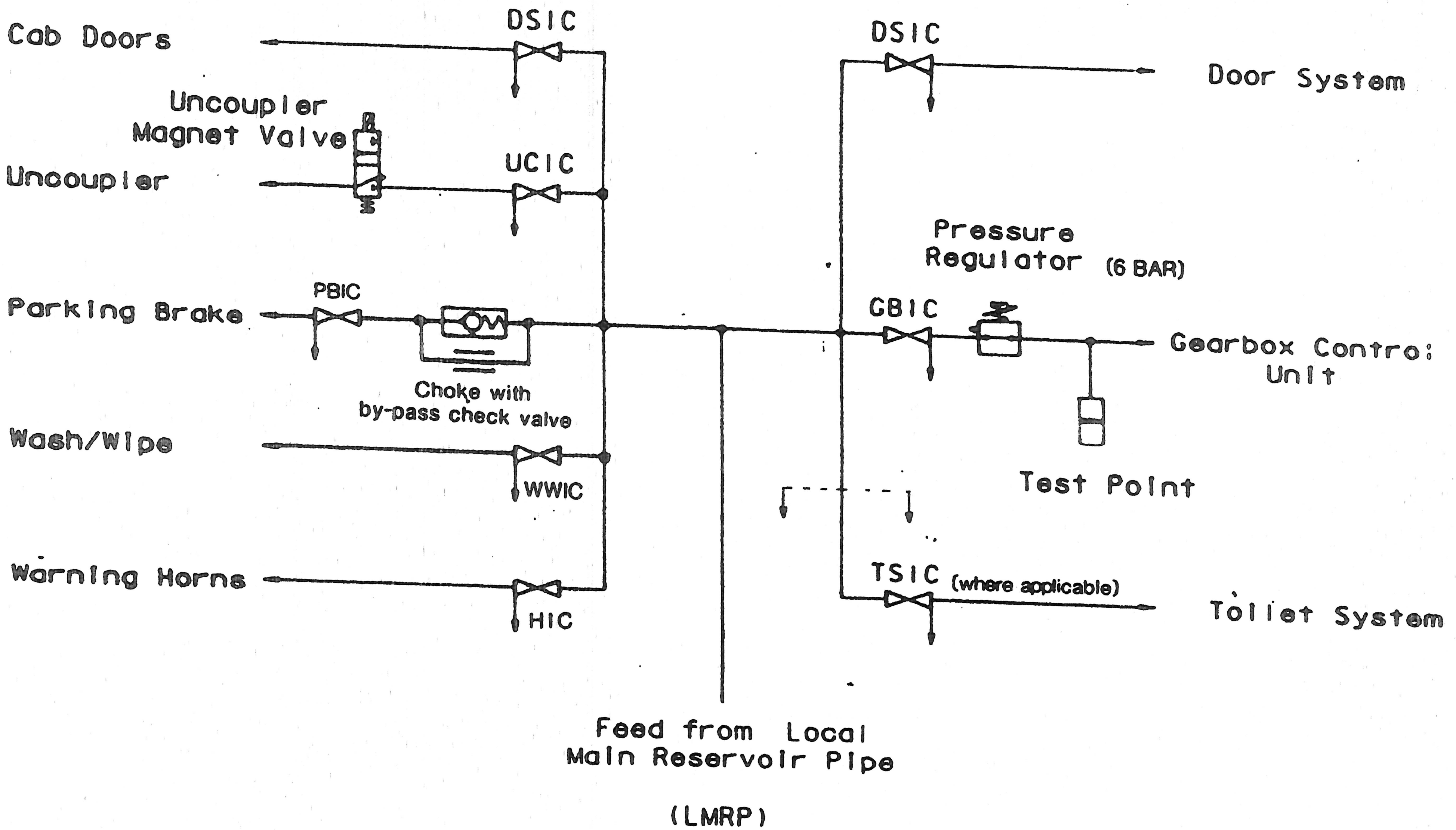
The gearbox control unit air supply isolating cock is found on the underframe adjacent to the pressure regulator and test point.

On the underframe at the rear of the vehicle near the transmission unit there are:-

a) Gearbox Isolating Cock GBIC with its adjacent pressure regulator and test point which controls the air supply to the transmission unit.

b) Door Supply Isolating Cock DSIC which controls the air supply to the passenger doors.

c) Toilet System Isolating Cock TSIC on DMOCL vehicles.


Cab Doors
DSIC
Uncoupler
Magnet Valve
UCIC
Uncoupler
PBIC
Parking Brake
Choke with
by-pass check valve
Wash/Wipe
WWIC
Warning Horns
HIC
DSIC
Door System
Pressure
Regulator (6 BAR)
GBIC
Gearbox Contro:
Unit
Test Point
TSIC (where applicable)
Toilet System
Feed from Local
Main Reservoir Pipe
(LMRP)

CAB AND AUXILIARY AIR SYSTEMS

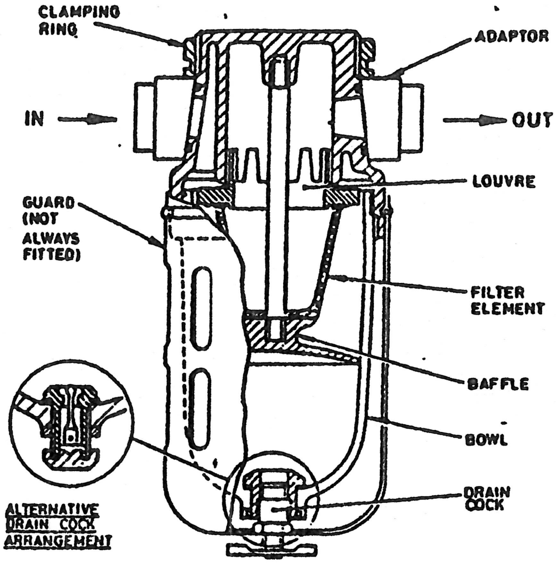
3. Air Supply System Components

3.1 Compressor Safety Valve.

This is a simple valve which operates at the pressure stamped on its housing which should be 9 bar.

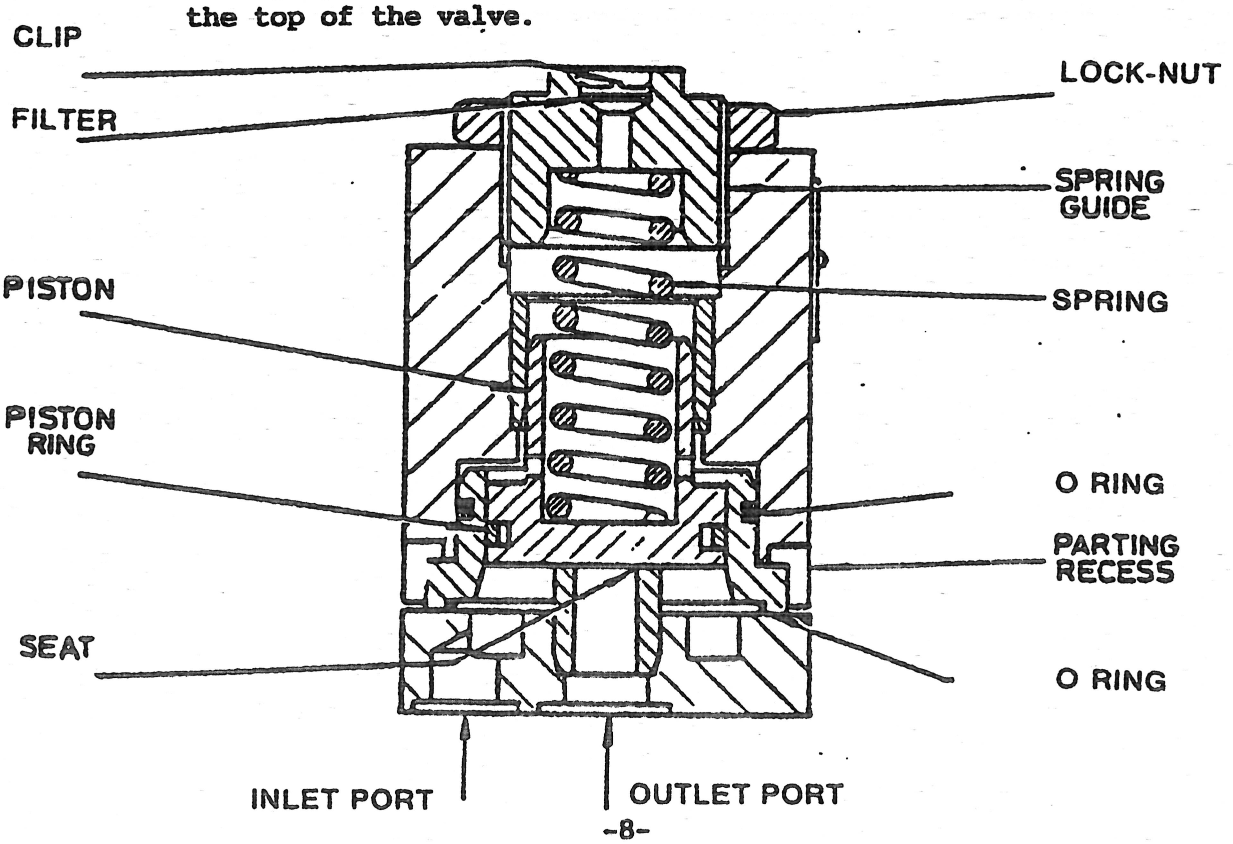
3.2 Filter

The filter in the engine air system has a main drain valve to remove any water it separates out from the air.


CLAMPING RING
ADAPTOR
IN
OUT
LOUVRE
GUARD (NOT ALWAYS FITTED)
FILTER ELEMENT
BAFFLE
BOWL
DRAIN COCK
ALTERNATIVE DRAIN COCK ARRANGEMENT

3.3 Preferential Air Valve

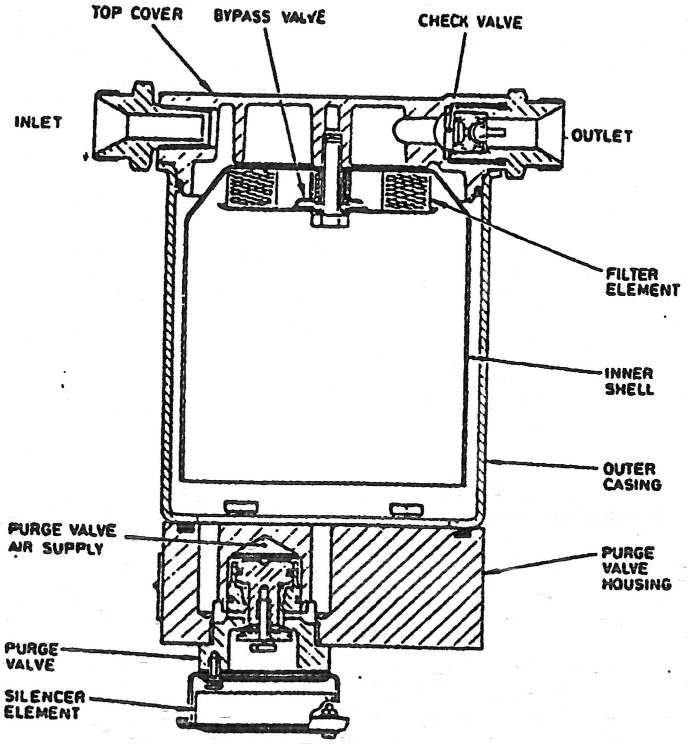
This valve prevents air from being fed through to the rest of the air supply system unless the delivery pressure exceeds 4.5 bar.
Air entering the valve acts on the piston until it overcomes the spring pressure.
The piston lifts and air can pass through to the outlet port.
Leakage past the piston escapes to atmosphere via the filter in the top of the valve.


CLIP
LOCK-NUT
FILTER
SPRING GUIDE
PISTON
SPRING
PISTON RING
O RING
PARTING RECESS
SEAT
O RING
INLET PORT
OUTLET PORT

3.4 Condenser Unit

This unit works in two stages: it removes moisture from the air supply and filters out any dirt particles.
Air enters the unit and passes down between the inner shell and outer casing. This cools the air.
Moisture and oil condenses out, and collects in the bottom of the unit above the purge valve.
The purge valve is opened by a pneumatic signal from the unloader magnet valve when the compressor is unloaded. The air pressure within the condenser then forces out any water through the purge valve and its silencer element.
The purge valve housing contains a heater element to stop the water freezing in cold weather.

The dried air passes up through the inner shell and through a filter element becomes blocked a by-pass valve will operate to permit air to continue to pass through the unit. At the outlet valve there is a check valve which prevents any back feed into the unit.


TOP COVER
BYPASS VALVE
CHECK VALVE
INLET
OUTLET
FILTER ELEMENT
INNER SHELL
OUTER CASING
PURGE VALVE AIR SUPPLY
PURGE VALVE HOUSING
PURGE VALVE
SILENCER ELEMENT

3.5 Twin Tower Air Dryer

The condenser unit only removes a certain amount of moisture from the air supply. The air must be much dryer if it is to be used in the door control system. A Twin Tower Air Dryer is used to dry the air to an acceptable standard.

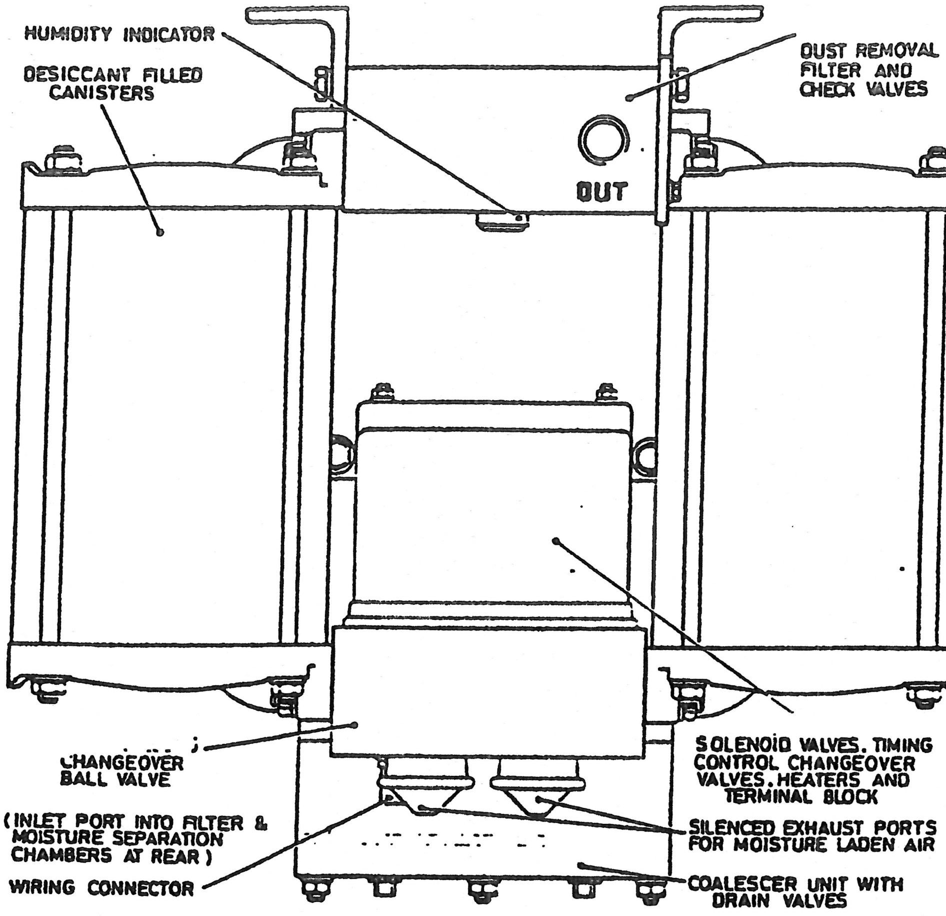
The Twin Tower Air Dryer has several major parts

a) Coalescing Filter Unit

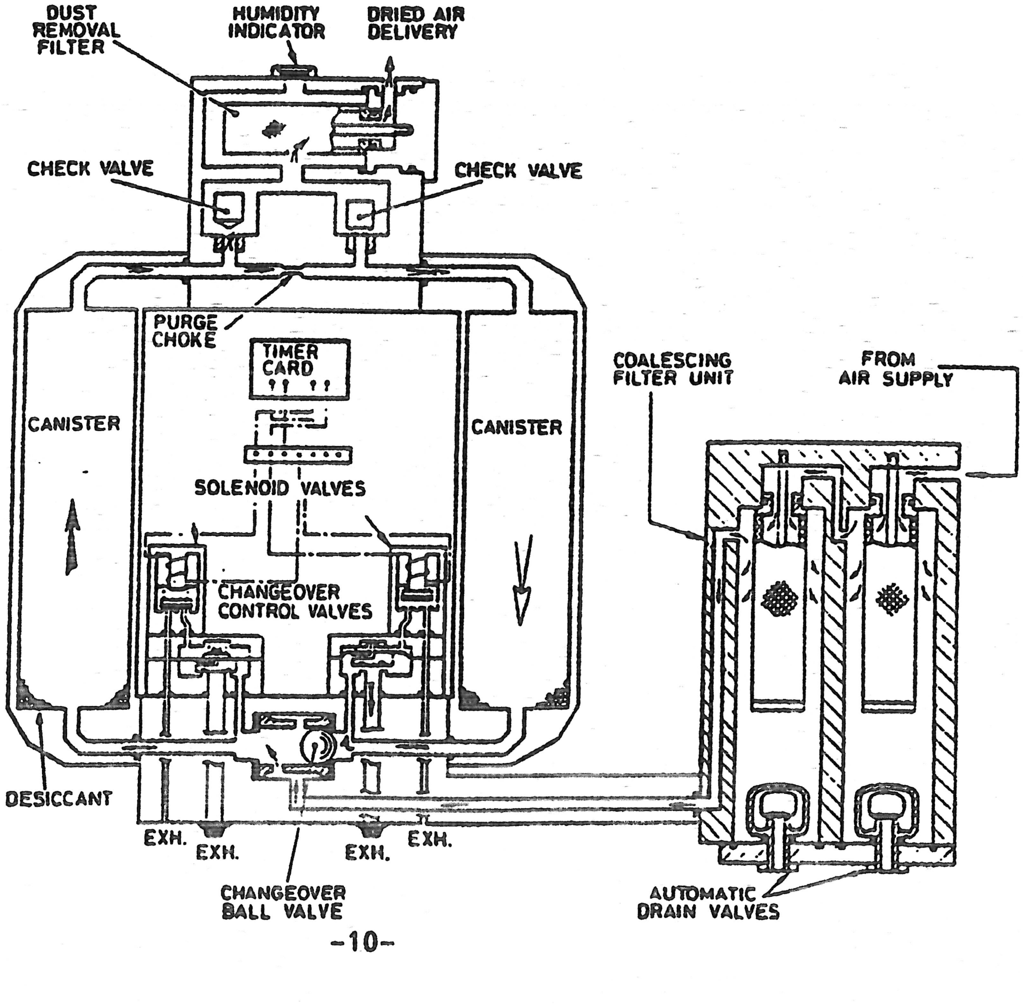
b) Changeover Unit

c) Two Drying Canisters

d) Outlet Filter


HUMIDITY INDICATOR
DESICCANT FILLED CANISTERS
DUST REMOVAL FILTER AND CHECK VALVES
OUT
CHANGEOVER BALL VALVE
(INLET PORT INTO FILTER & MOISTURE SEPARATION CHAMBERS AT REAR)
WIRING CONNECTOR
SOLENOID VALVES, TIMING CONTROL CHANGEOVER VALVES, HEATERS AND TERMINAL BLOCK
SILENCED EXHAUST PORTS FOR MOISTURE LADEN AIR
COALESCER UNIT WITH DRAIN VALVES

TWIN TOWER AIR DRYER


DUST REMOVAL FILTER
HUMIDITY INDICATOR
DRIED AIR DELIVERY
CHECK VALVE
CHECK VALVE
PURGE CHOKE
TIMER CARD
CANISTER
CANISTER
SOLENOID VALVES
CHANGEOVER CONTROL VALVES
COALESCING FILTER UNIT
FROM AIR SUPPLY
DESICCANT
EXH.
EXH.
EXH.
EXH.
CHANGEOVER BALL VALVE
AUTOMATIC DRAIN VALVES

3.5 Twin Tower Air Dryer (cont'd)

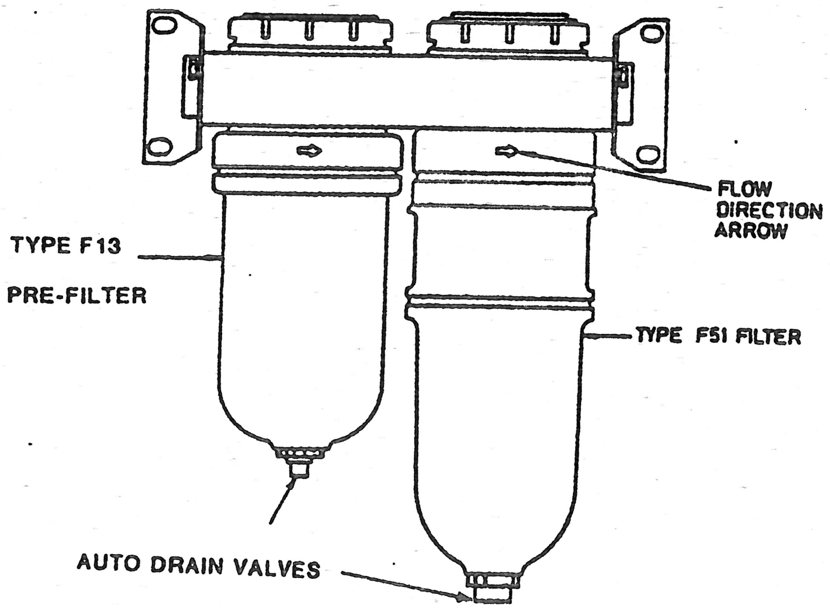
Air entering the unit initially passes through a twin chamber heated coalescing filter unit.
This filter unit removes any dirt, that may contaminate the desiccant in the drying canisters, and also moisture carried over from the condenser unit. Each chamber has an automatic drain valve.
Air from the coalescing filter enters the towers via a changeover unit. Controlled by an electronic timer circuit. The changeover unit directs the air to one of the two drying towers. The drying towers each contain a canister of regenerating desiccant (activated alumina) to act as the drying agent. The air passes through the desiccant and then through a check valve and dust removal filter to the outlet port. To allow desiccant to regenerate, some of the dried air is passed down through the other canister. This purge air and any moisture from the second canister are exhausted via the changover unit.
After a pre-set time (determined by the electronic timer) the changeover unit reverser the air flow system through the drying towers. This allows desiccant in the "first" tower to regenerate whilst using the second tower as the drier.
The change-over unit is fail safe - air will continue to flow through the unit if any component fails.
There is an humidity indicator by the outlet port which changes from blue to pink if the desiccant needs changing.

Maintenance Point

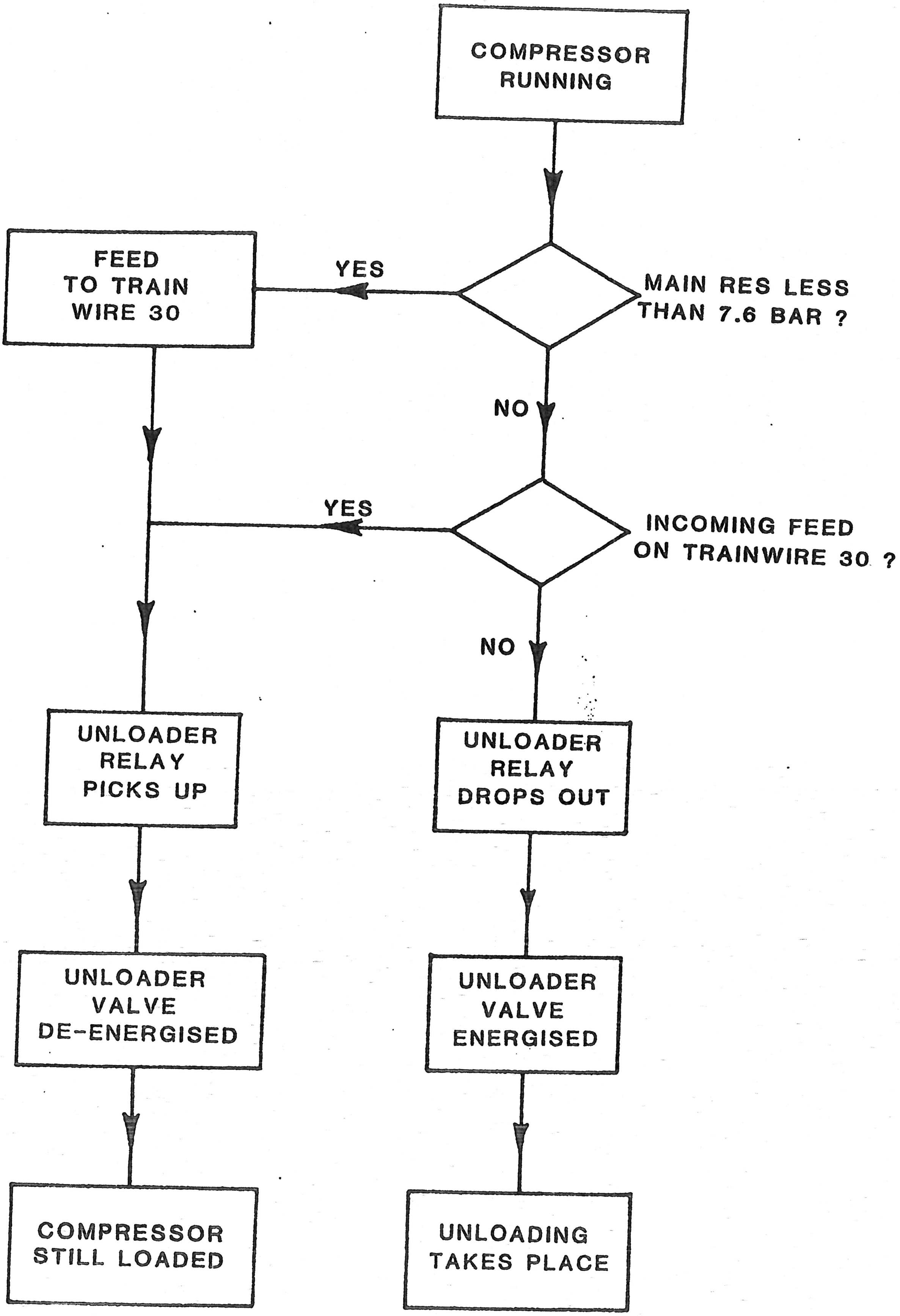
Before changing the desiccant, check that changeover unit is functioning by checking air flow at the exhaust ports.
A faulty drain valve is indicated when the liquid level is inside a filter chamber.

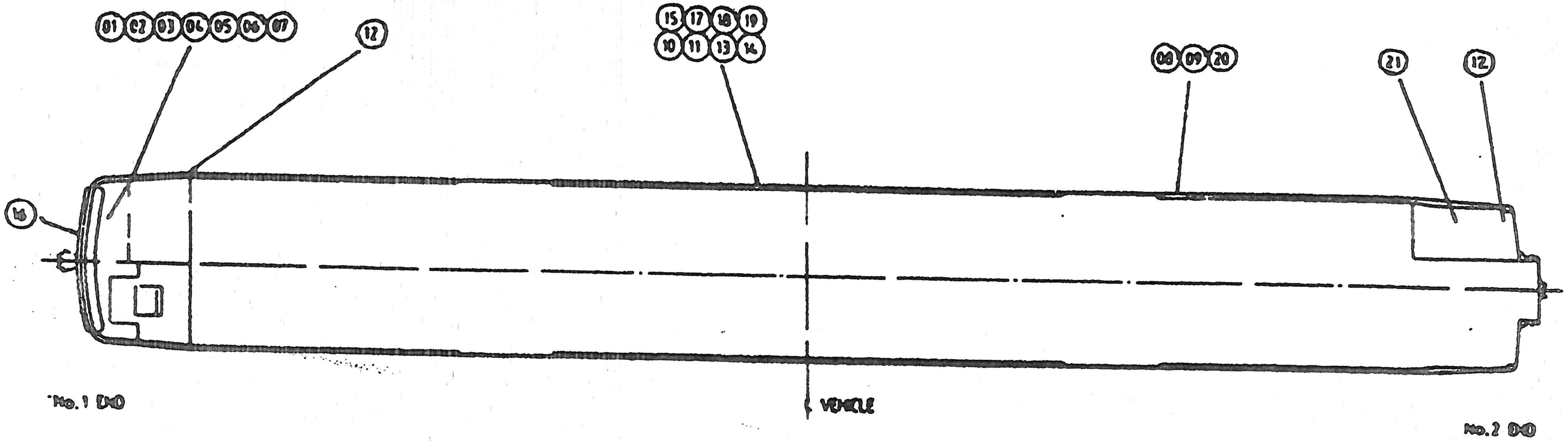
3.6 Combined Water Separator And Coalescing Oil Filter

This is used to clean and dry air supplied to the local main reservoir pipe from the main reservoir pipe when the vehicles' compressor is inoperative.
It will not be used very often which allows it to be a smaller arrangement than used to dry the output from the compressor.



3.7: OPERATION OF COMPRESSOR UNLOADER


COMPRESSOR RUNNING
MAIN RES LESS THAN 7.6 BAR ?
YES
FEED TO TRAIN WIRE 30
NO
INCOMING FEED ON TRAINWIRE 30 ?
YES
NO
UNLOADER RELAY PICKS UP
UNLOADER RELAY DROPS OUT
UNLOADER VALVE DE-ENERGISED
UNLOADER VALVE ENERGISED
COMPRESSOR STILL LOADED
UNLOADING TAKES PLACE

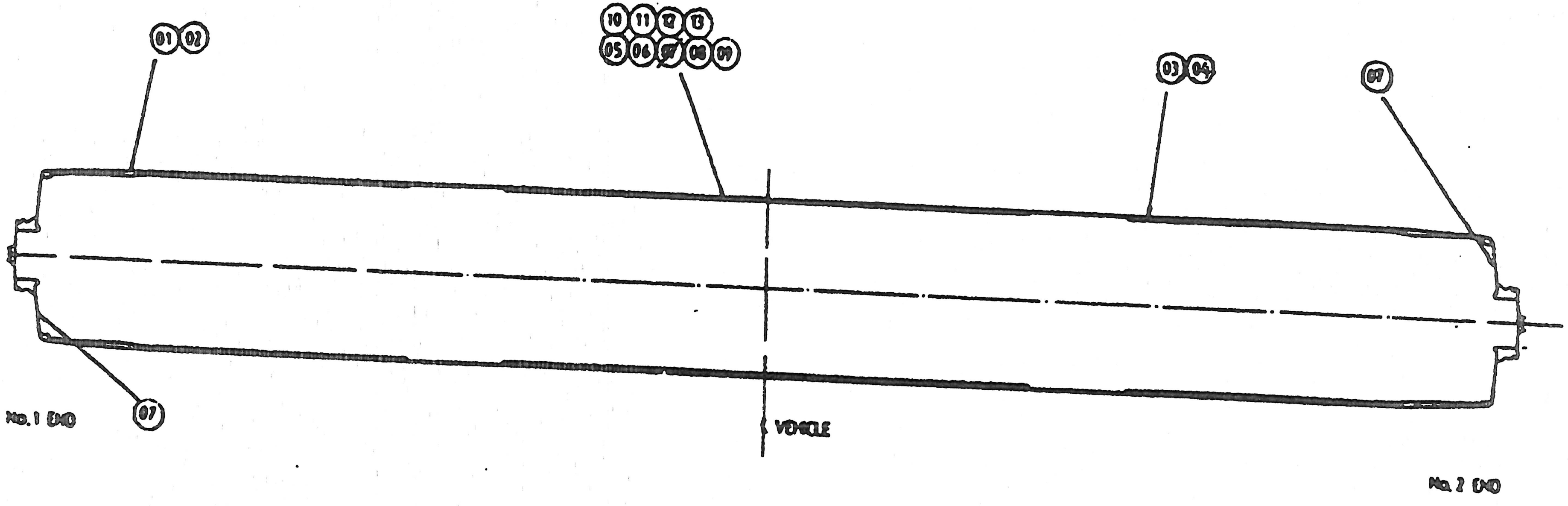


KEY (LOCATION)

NDO — ON DRIVERS DESK
CSW — CAB SIDE WALL
UN — UNDERFRAME
BF — BRAKE FRAME
TC — TOILET CUPBOARD

REF	DESCRIPTION	LOCATION	ABBREVIATION
01	UNCOUPLER SUPPLY	NDO	UCIC
02	PARKING BRAKE SUPPLY	NDO	PBIC
03	PARKING BRAKE EP VALVE BY-PASS	NDO	PB BY-PASS
04	WINDSCREEN WIPER SUPPLY	NDO	WWIC
05	WARNING HORN SUPPLY	NDO	HIC
06	CAB DOOR SUPPLY	NDO	CAB DSIC
07	EMERGENCY PARKING BRAKE APPLICATION	CSW	EPBAC
08	DOOR SUPPLY	UN	DSIC
09	GEARBOX SUPPLY	UN	GBIC
10	COMPRESSOR GOVERNOR	BF	CGIC
11	MAIN RESERVOIR PIPE	BF	MRPIC
12	MAIN RESERVOIR PIPE COUPLER	UN	MRPCC
13	MAIN RESERVOIR PIPE FILTER	BF	MRFIC
14	AIR SUSPENSION RESERVOIR	BF	ASRIC
15	BRAKE SUPPLY RESERVOIR	BF	BSRIC
16	EMERGENCY COUPLING	UN	ECIC
17	AIR SUSPENSION (No. 1 END)	BF	ASIC (No. 1)
18	AIR SUSPENSION (No. 2 END)	BF	ASIC (No. 2)
19	BRAKE CYLINDER	BF	BCIC
20	TOILET SUPPLY (DMOCL A/B ONLY)	UN	TSIC
21	TOILET SUPPLY (DMOCL A/B ONLY)	TC	TSIC

3.8: ISOLATING COCK DIAGRAM - DRIVER VEHICLES



KEY (LOCATION)
UN — UNDERFRAME
BF — BRAKE FRAME

REF	DESCRIPTION	LOCATION	ABBREVIATION
01	PARKING BRAKE SUPPLY	UN	PBIC
02	PARKING BRAKE EP VALVE BY-PASS	UN	PB BY-PASS
03	DOOR SUPPLY	UN	DSIC
04	GEARBOX SUPPLY	UN	GBIC
05	COMPRESSOR GOVERNOR	BF	CGIC
06	MAIN RESERVOIR PIPE	BF	MRPIC
07	MAIN RESERVOIR PIPE COUPLER	UN	MRPCC
08	MAIN RESERVOIR PIPE FILTER	BF	MRFIC
09	AIR SUSPENSION RESERVOIR	BF	ASRIC
10	BRAKE SUPPLY RESERVOIR	BF	BSRIC
11	BRAKE CYLINDER	BF	BCIC
12	AIR SUSPENSION (No. 1 END)	BF	ASIC (No. 1)
13	AIR SUSPENSION (No. 2 END)	BF	ASIC (No. 2)

3.9: ISOLATING COCK DIAGRAM - INTERMEDIATE VEHICLES